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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/759,447	01/16/2004	James E. Lamb III	27269-CNT7	7841
23589	7590	06/16/2005	EXAMINER	
HOVEY WILLIAMS LLP 2405 GRAND BLVD., SUITE 400 KANSAS CITY, MO 64108			NOVACEK, CHRISTY L	
			ART UNIT	PAPER NUMBER
			2822	

DATE MAILED: 06/16/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/759,447

Applicant(s)

LAMB ET AL.

Examiner

Christy L. Novacek

Art Unit

2822

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 27 July 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-18 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-18 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 09 August 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- ☒ Notice of References Cited (PTO-892)
- ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date 4/16/04, 1/4/05.
- ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- ☐ Notice of Informal Patent Application (PTO-152)
- ☐ Other: _____.

DETAILED ACTION

This office action is in response to the preliminary amendment filed July 27, 2004.

Drawings

The replacement drawings were received on August 9, 2004. These drawings are approved.

Information Disclosure Statement

In the signed and initialed copy of the information disclosure statement filed April 16, 2004, the reference listed as US Patent 6,329,1~~88~~, date 12/11/01, Hussein et al. has been lined through because the inventor and patent date do not match that patent. This reference appears to be a typographical error. US Patent 6,329,1~~18~~ matches the patent date and inventor listed for the US 6,329,188 reference. US Patent 6,329,118 is listed on Applicant's same IDS and has been considered.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1 and 8-18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Moon et al. (US 6,649,515) in view of Meador et al. (US 6,156,479).

Regarding claim 1, Moon discloses applying a fill composition (160) to a contact or via hole having a bottom and sidewalls and formed in a substrate, with the composition being useful for protecting the substrate during etching processes (col. 2, ln. 58 – col. 3, ln. 4). Moon states that the fill composition may be made of a polymer material, but Moon does not describe any specific formulation for this composition (col. 4, ln. 19-34). Moon discloses that after fill composition is applied to the bottom and sidewalls of the via hole, a photoresist is deposited onto the structure and is photo-imaged for a subsequent etching step. Meador discloses an antireflective coating (ARC) composition that is advantageous to use underneath a photoresist because the ARC reduces distortion in the photo-imaging of the photoresist, which results in more sharply defined etched structures to be formed. Like Applicant's fill composition, the ARC composition of Meador is made of a polymer binder of polyacrylate, a cross-linking agent of an aminoplast and a solvent of PGME that is spin-coated onto a wafer and is cured at a temperature of 120-225°C (col. 3, ln. 47-65). At the time of the invention, it would have been obvious to one of ordinary skill in the art to use the ARC of Meador for the polymer fill composition of Moon because by virtue of the film's antireflective nature, the subsequent photo-imaging disclosed by Moon can be made more precise, resulting in an improved interconnection structure.

Further regarding claim 1, Meador does not specifically disclose that the ARC is at least about 70% removed when subjected to a pre-bake thermal stability test and has less than 15% shrinkage when subjected to a film shrinkage test. However, because the ARC of Meador includes the same polymer binder, cross-linking agent and solvent disclosed by Applicant, it appears that the ARC of Meador would inherently possess the function of being at least about 70% removed when subjected to a pre-bake thermal stability test and has less than 15%

Art Unit: 2822

shrinkage when subjected to a film shrinkage test. See *In re Swinehart*, 439 F.2d 210, 212-13, 169 USPQ 226, 229 (CCPA 1971) “where the Patent Office has reason to believe that a functional limitation asserted to be critical for establishing novelty in the claimed subject matter may, in fact, be an inherent characteristic of the prior art, it possesses the authority to require the applicant to prove that the subject matter shown to be in the prior art does not possess the characteristics relied on”); and *In re Fitzgerald*, 619 F.2d 67, 205 USPQ 594 (CCPA 1980) (a case indicating that the burden of proof can be shifted to the applicant to show that the subject matter of the prior art does not possess the characteristic relied on whether the rejection is based on inherency under 35 U.S.C. 102 or obviousness under 35 U.S.C. 103).

Regarding claim 8, Moon and Meador disclose that the fill composition/ARC can be applied to the bottom and sidewalls of the via hole by spin coating the composition to the surface of the substrate.

Regarding claim 9, Meador does not specifically disclose the flash point of the solvent system. However, because the ARC of Meador includes the same solvent disclosed by Applicant, it appears that the solvent system of Meador would inherently possess the function of having a flash point of greater than 85°C. See *In re Swinehart*, 439 F.2d 210, 212-13, 169 USPQ 226, 229 (CCPA 1971) “where the Patent Office has reason to believe that a functional limitation asserted to be critical for establishing novelty in the claimed subject matter may, in fact, be an inherent characteristic of the prior art, it possesses the authority to require the applicant to prove that the subject matter shown to be in the prior art does not possess the characteristics relied on”); and *In re Fitzgerald*, 619 F.2d 67, 205 USPQ 594 (CCPA 1980) (a case indicating that the burden of proof can be shifted to the applicant to show that the subject matter of the prior art

Art Unit: 2822

does not possess the characteristic relied on whether the rejection is based on inherency under 35 U.S.C. 102 or obviousness under 35 U.S.C. 103).

Regarding claim 10, Meador discloses that the polymer binder has a molecular weight of 2000-30000 (col. 4, ln. 45-55).

Regarding claim 11, Meador discloses that the polymer binder can include polyacrylate (col. 4, ln. 45 – col. 5, ln. 11).

Regarding claims 12 and 13, Meador discloses that the solvent can include PGME (an ether) (col. 6, ln. 17-26).

Regarding claim 14, Meador discloses that the ARC composition includes a cross-linking agent (col. 5, ln. 59 – col. 6, ln. 15).

Regarding claim 15, Meador discloses that the polymer binder includes a cross-linking moiety.

Regarding claim 16, Meador discloses curing the composition at a temperature of 120-225°C.

Regarding claim 17, Meador does not specifically disclose the melting point of the solid components when mixed together. However, because the ARC of Meador includes the same solid components disclosed by Applicant, it appears that the solid components mixture of Meador would inherently possess the function of having a melting point of less than 200°C. *In re Swinehart*, 439 F.2d 210, 212-13, 169 USPQ 226, 229 (CCPA 1971) “where the Patent Office has reason to believe that a functional limitation asserted to be critical for establishing novelty in the claimed subject matter may, in fact, be an inherent characteristic of the prior art, it possesses the authority to require the applicant to prove that the subject matter shown to be in the prior art

Art Unit: 2822

does not possess the characteristics relied on ”); and *In re Fitzgerald*, 619 F.2d 67, 205 USPQ 594 (CCPA 1980) (a case indicating that the burden of proof can be shifted to the applicant to show that the subject matter of the prior art does not possess the characteristic relied on whether the rejection is based on inherency under 35 U.S.C. 102 or obviousness under 35 U.S.C. 103).

Regarding claim 18, Moon discloses that the fill composition and the substrate have approximately equal etch rates (col. 4, ln. 35-45).

Claims 2-7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Moon et al. (US 6,649,515) in view of Meador et al. (US 6,156,479) as applied to claim 1 above, and further in view of Parekh (US 6,284,641).

Regarding claim 2, Meador discloses that the ARC is capable of being cross-linked at a cross-linking temperature, but Meador does not disclose reflowing the ARC. Parekh teaches that when depositing a composition such that it is desired to have the composition fill a small opening, it is advantageous to heat the composition to its reflow temperature so as to allow the composition to completely fill the small opening in a way that it would not otherwise be able to do (col. 8, ln. 34-50). At the time of the invention, it would have been obvious to one of ordinary skill in the art to subject the ARC to a reflow heating step before cross-linking of the ARC, so that the ARC can completely conformally fill the small via opening, thereby being able to cover and protect all of the opening that is in contact with it.

Regarding claim 3, Meador does not specifically disclose the reflow temperature of the ARC. However, because the ARC of Meador includes the same polymer binder, cross-linking agent and solvent disclosed by Applicant, it appears that the ARC of Meador would inherently

Art Unit: 2822

possess the function of having a reflow temperature of less than 120°C. See *In re Swinehart*, 439 F.2d 210, 212-13, 169 USPQ 226, 229 (CCPA 1971) “where the Patent Office has reason to believe that a functional limitation asserted to be critical for establishing novelty in the claimed subject matter may, in fact, be an inherent characteristic of the prior art, it possesses the authority to require the applicant to prove that the subject matter shown to be in the prior art does not possess the characteristics relied on ”); and *In re Fitzgerald*, 619 F.2d 67, 205 USPQ 594 (CCPA 1980) (a case indicating that the burden of proof can be shifted to the applicant to show that the subject matter of the prior art does not possess the characteristic relied on whether the rejection is based on inherency under 35 U.S.C. 102 or obviousness under 35 U.S.C. 103).

Regarding claim 4, Meador discloses curing the ARC by heating the composition to at least its cross-linking temperature.

Regarding claim 5, Moon shows that the fill composition in the via hole can have a depth of over 50% of the depth of the hole (Fig. 4).

Regarding claims 6 and 7, Moon shows that the fill composition in the via hole can have a relatively shallow depth compared to that of the hole, but does not specifically disclose any particular depth of the fill composition. However, Moon states, “only enough sacrificial material 160 is needed to preserve underlying first mask layer 120 during a trench etch to form a trench pattern for a subsequent copper interconnection line” (col. 4, ln. 36-39). At the time of the invention, it would have been obvious to one of ordinary skill in the art to use routine experimentation to determine an optimal thickness for the fill composition within the via hole of Moon, depending upon the material of the substrate and the etchants used to etch the substrate, because such variables of art recognized importance are subject to routine experimentation and

Art Unit: 2822

discovery of an optimum value for such variables is obvious. See *In re Aller*, 105 USPQ 233 (CCPA 1955).

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Christy L. Novacek whose telephone number is (571) 272-1839. The examiner can normally be reached on Monday-Thursday and alternate Fridays 7:30 - 5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amir Zarabian can be reached on (571) 272-1852. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

CLN
June 13, 2005


AMIR ZARABIAN
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2800

Approved *CX* 6/10/05



LAMB et al.; S.N. 10/759,447; Confirmation No. 7841
IMPROVED FILL MATERIAL FOR DUAL DAMASCENE PROCESSES
Docket No. 27269-CNT7
Page 1 of 13

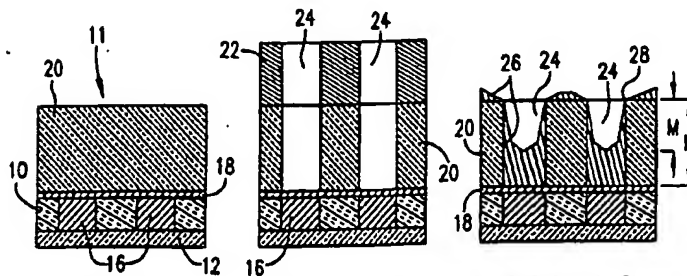


FIG. 1A.
PRIOR ART

FIG. 1B.
PRIOR ART

FIG. 1C.
PRIOR ART

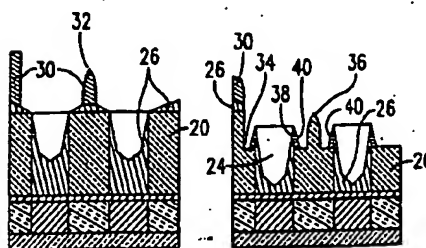


FIG. 1D.
PRIOR ART

FIG. 1E.
PRIOR ART

FIG. 1F.
PRIOR ART

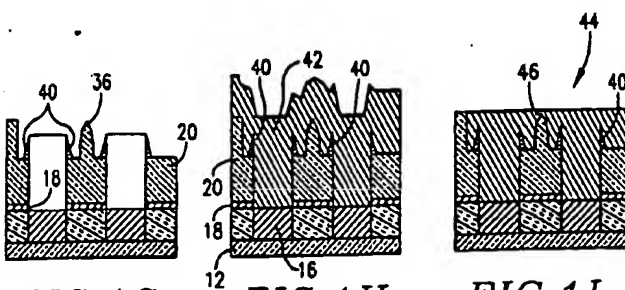


FIG. 1G.
PRIOR ART

FIG. 1H.
PRIOR ART

FIG. 1I.
PRIOR ART